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Control of Intestinal Worms of Chickens

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INTESTINAL worms are now commonly found in all sections of the state, and, without doubt, reduce poultry profits. While there are no data at hand regarding the extent of worm infestation in Ohio, a recent publication from a neighboring state shows that out of 1,000 birds examined at the State Agricultural College, 49 per cent were infested with the large roundworm of the intestinal tract, 66 per cent were infested with cecum worms, and 49 per cent with tapeworms. This condition points out the need for concerted action on the part of poultry raisers in order to reduce losses from parasitism.

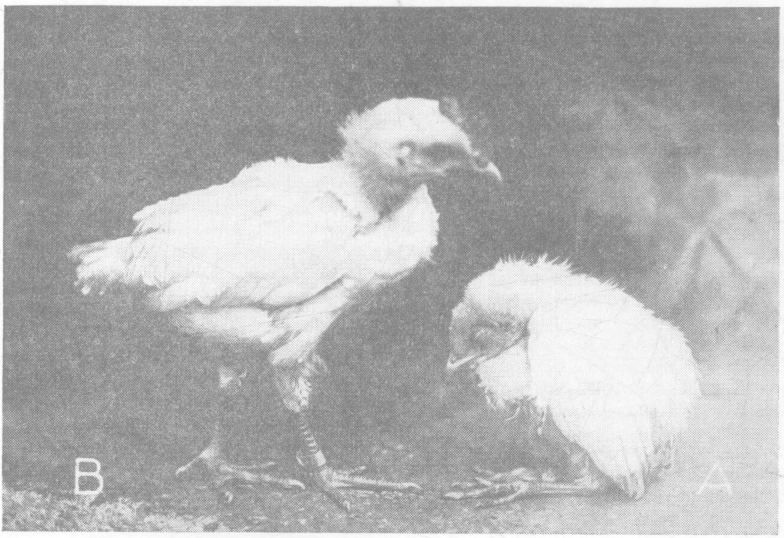

Fig. 1.—Chicks from same hatch, but raised separately. *A* shows chick with typical symptoms of infestation and post mortem showed the presence of worms; *B*, chick raised under sanitary conditions. (Courtesy Kansas Agl. College).

It is a well-known fact that mature birds will carry a few intestinal parasites with apparently no ill effects. This fact has led some to believe that intestinal worms are not a serious menace. This, however, is not the case, and it has been definitely proved that while slight infestations may not impair the health of normal, mature birds, even a few worms may be fatal to growing chicks. There exists a condition (termed a true-parasitism), where the parasite and the host live together without any particular damage to one or the other. However, in case the vitality of the host should be impaired, the parasite will rapidly get the upper hand and produce symptoms of parasitism.

The Ohio State University, Cooperating with the United States Department of Agriculture, Agricultural College Extension Service, H. C. Ramsower, Director, Columbus, Ohio.
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Damage Done by Worms

Investigators have shown various types of damage to result from worm infestations. J. R. Beach of the California Experiment Station reports that heavy parasitism results in loss of flesh, frequently a persistent diarrhea, and often a paralysis of one or both legs. G. W. Herrick, Kansas Experiment Station, reports greatly retarded growth, muscular deficiency, and a mortality of 23 per cent in young chicks as a result of the presence of parasites. J. E. Ackert, of the same Station, has shown that the highest mortality occurs during the third week of parasitism, at which time, in the case of roundworms, the young roundworms or larvae bury their anterior ends in the mucosa of the intestinal tract, causing loss of blood and bloody fluids. Ackert also throws interesting light on the effect of parasites by showing that the large roundworm causes shrunken thymus glands and a reduction of sugar in the blood. This means that where parasitism exists, the bird will be unable to make normal growth or properly assimilate and use food materials.

An interesting observation on the presence of the small cecum worm, or pinworm, was made by Tyzzer of Harvard University. It has generally been supposed that this worm causes very little damage. However, Tyzzer has demonstrated that the cecum worm is capable of spreading blackhead in turkeys, and inasmuch as chickens are also affected with blackhead, this may be of importance, particularly when chickens and turkeys are both raised.

It will readily be seen, from the conditions described, that the damage done by worms is very largely one of reducing vitality and normal resistance to disease. Where heavy parasitism exists, flocks are frequently found to be affected by such diseases as colds and roup. In other words, with the normal resistance reduced, the birds are liable to contract, to a serious degree, any disease to which they may become exposed.

Tapeworms of Chickens

In order to understand the characteristic life habits and life cycles of these parasites, a short review follows. It is essential, in combating any parasite, for one to be familiar with the methods which the parasite uses in spreading from one bird to another. Tapeworms may be distinguished from other intestinal parasites by the fact that they are flat, segmented, and attached to the intestinal wall by a head or scolex. All tapeworms require an intermediate host to aid in the multiplication and distribution of the parasite. This is of particular interest, since it indicates one of the necessary steps in combating tapeworm infestations.

The tapeworm attaches itself to the intestinal wall by means of the head, and proceeds to produce segments. As the process of segmentation progresses, the end segments are dropped off as they become mature. Each of these mature segments is sexually complete and contains, at the time it leaves the worm, thousands of eggs. These segments leave the bird with the contents of the intestinal tract. A second bird may consume these segments and not acquire tapeworms. In order to complete the cycle, it is necessary that these tapeworm eggs be consumed by a suitable secondary host and that they go through a stage of development in the body of the secondary host. This change results in the egg "incubating" and going into an encysted stage protected by a heavy wall. This body may migrate from the intestinal tract to the muscles or other parts of the body. Here it lies dormant until the secondary host is eaten by the primary host. *This is the only known means by which tapeworms may spread.* The tapeworm "cysticereoid" is liberated after the chicken has digested off the body of the carrier. The embryonic tapeworm, emerging from the protective cover, attaches itself immediately to the wall of the intestine and proceeds to grow.

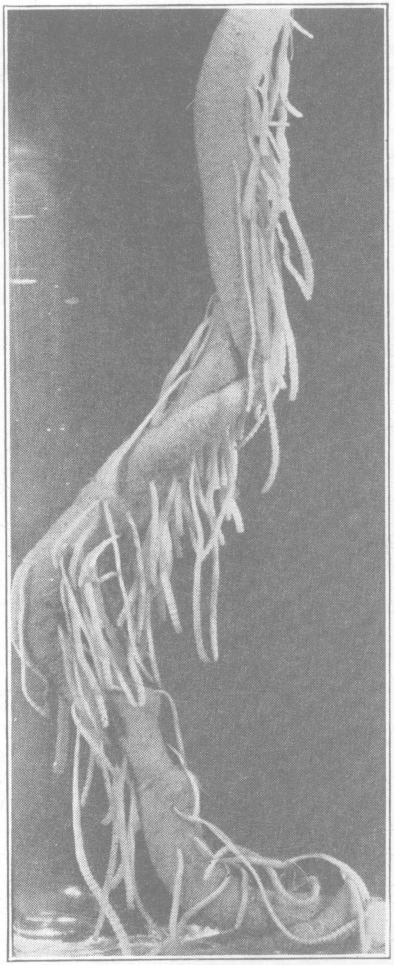

Fig. 2.—Section of hen's intestine turned inside out to show the large tapeworms attached to the intestinal wall.

Since the tapeworm is attached firmly to the intestinal wall (see Fig. 2), some of the recommended treatments which will remove the worms do considerable damage to the chicken. It is, therefore, very apparent that the most logical and sensible procedure in the control of tapeworm infestations is *prevention.* In order to adopt suitable preventive steps, let us discover what forms of animal life act as carriers of tapeworms.

While there are over thirty known species of tapeworms which affect chickens, there are only five which are common in the midwest, and two others which have been reported from time to time. The best authorities on parasitism, at the present time, agree that the following insects and crustaceans act as carriers: the house fly has been credited with carrying three distinct species; ground beetles and dung beetles have recently been described by Dr. Eloise B. Cram of the United States Department of Agriculture as carriers of two species; stable flies and snails have also been reported as carriers. These hosts are responsible for carrying four of the more common species of tapeworms; for the fifth, there has been found no intermediate host as yet. The two species of tapeworms less frequently found are carried by earthworms and slugs.

W. L. Chandler, of Michigan, has reported an oviduct fluke which appears to be of considerable importance in domestic fowls and also in wild birds on the shores of a lake in that state. While this has not been reported in Ohio, there is a possibility of its spread, since migrant birds may serve as carriers. The intermediate host of this fluke has been found to be a species of dragon fly. The fluke attaches itself to the inside of the oviduct and has been demonstrated to stop production and interfere materially with the health of the bird. This has not been reported except where the birds have been allowed to range on lake or river shores and pick up dragon fly larvae or nymphs.

Roundworms

The Large Roundworm.—There are several species of roundworms which infest poultry. The most important one, however, is the large roundworm of the intestinal tract *(Ascaridia lineata).* These worms, when mature, are about 2 to 3 inches in length (see Fig. 3), are white, and round. They do not attach themselves to the intestinal wall, as do the tapeworms.

Roundworms do not require an intermediate host as do the tapeworms; their life cycle is direct. The female roundworm produces the eggs, which pass out with the intestinal contents. The eggs require an incubation period; under favorable conditions (which are humidity and room temperature or slightly lower), F. R. Beaudette of New Jersey reports incubation to take place in a period of from eight to ten days. However, under adverse conditions, the incubation period may be considerably longer and may extend as long as three weeks or more. It is interesting to note that the worm eggs will withstand considerable exposure, and that temperatures of 11° F. to 18° F. for a period of fifteen hours were not sufficient to kill the eggs. However, too long an exposure at this temperature would destroy them. Ackert reports that 110° F. will cause death and that, under Kansas conditions, summer heat was sufficient to kill the worm eggs in the soil down to a depth of 2, 4, and 6 inches in unshaded soil. He showed, however, that in shady places the worm eggs retained their vitality for a period of at least one hundred days.

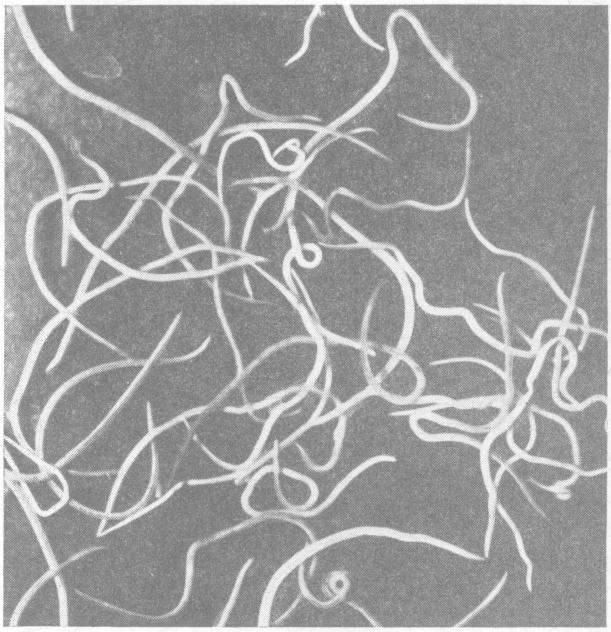

Fig. 3.—Roundworms from the small intestine of a chicken, actual size. (Courtesy Kansas Agr. College).

After the eggs have incubated there appears within the egg a small coiled larvae. The eggs are picked up by the birds and taken into the intestinal tract. The outer wall, or "shell," is digested off in the gizzard and in the intestine, liberating the larvae. The larvae are then found to take up their abode among the "villa" (folds in mucous lining) of the intestine.

Thus protected, they continue to grow until the tenth day when they bore into the mucous tissue, destroying the glands. After the twentieth day, they emerge into the intestinal tract, and grow to maturity in about two months. Ackert reports that chicks which have been raised free from parasites and which are healthy, are practically resistant after they have reached the age of three months. Herrick reports that chickens at 103 days of age are fifty times as resistant to the attacks of roundworms as a chick 15 days of age.

The Cecum Worm.—The small cecum worm *(Heterakis gallinae)* is found more frequently, perhaps, than any other of the intestinal parasites, but to date has not been credited with doing a great deal of damage. This worm will be found in the ceca or blind intestine. It is much smaller than the large roundworm of the intestinal tract, being not more than ½ inch in length. It has been credited with carrying the causitive organism of blackhead in turkeys, which disease, while commonly found in chickens, is not often serious, but is very fatal to turkeys.

The life cycle of the cecum worm is very similar to that of the large roundworm. The eggs are thrown off with the droppings and incubate in the soil for a period of about two weeks. After incubation, they are picked up by the birds and released in the intestine and migrate to the ceca, where they bury themselves in the mucosa for a few weeks, and reach maturity in about two months. It is interesting to note that neither the eggs of the large roundworm nor the pinworm are dangerous until they have become incubated. A bird may consume un-incubated eggs and not acquire the parasites.

The Gapeworm.—A third roundworm which is still common in some sections, but not serious, is the gapeworm *(Syngamus trachea)*. This worm causes pronounced symptoms of gaping in young chicks by lodging in the trachea or windpipe. Apparently, chickens are only susceptible when very young, and do not act as carriers. Turkeys, however, while they have apparently never been affected by the disease, act as carriers and aid in its spread.

The eggs of the gapeworm incubate to an infective stage in the soil, where they can be picked up by chicks. Earthworms have been found to assist in carrying gapeworms and the larval stages of gapeworms have been found in earthworms. However, earthworms are not necessary as intermediate hosts.

Other Species of Roundworms.—There are several other roundworms, the economic importance of which has not been definitely determined. Among these are the crop worm of chickens *(Capillaria annulata)*, described by Dr. Cram as being quite common. It is a slender, threadlike, colorless worm, "sewed" into the lining of the crop, and difficult to extract without breaking. Dr. Cram states that the presence of the worm causes a mild inflammation of the wall of the crop, and in some cases a thickening.

The same authority states that there are three species of capillaria found in the intestines of chickens. It is difficult to find them, as they are very minute and are usually found in a coiled position. As to how common these worms are in Ohio, and as to the damage they do, we have no definite information. It would doubtless be advisable for people making postmortem examinations to attempt to discover their presence.

Strict Sanitation the Best Preventive

It is an old adage that an ounce of prevention is worth a pound of cure. Without question, it is very applicable to intestinal parasitism. In the first place, it usually happens that much damage has been done before the presence of the worms has been determined. This damage may take one or many of the forms mentioned on page 2.

Treatment for roundworms is very effective and does not usually throw the birds off condition. However, some treatments for tapeworms are severe, and cases have been reported where considerable damage has been done by the treatment. It is always a question, after once the vigor and vitality of the birds has been reduced by parasites, if they return to normal good health and to productiveness for some time after treatment. The expense and labor involved in treating is considerable, and it is clearly indicated that wherever there has been any history of worm infestation, every effort should be made to

raise the pullet crop free from parasites rather than attempting to treat the birds after they have become heavily parasitized.

The following precautions should be taken before trouble appears. If there has been any history of worm infestation in the flock or on the farm, these precautions should be observed to even a greater extent.

1. Young chicks should be raised away from the old hens. Old hens act as spreaders of all parasites and should be kept away from the growing flock.
2. Raise the chickens on clean soil, where the old hens have not been allowed to range, and entirely away from the barnyard and manure piles where flies and other insects which may act as carriers can breed.
3. Clean all poultry houses regularly. Dropping boards should be cleaned daily and the manure immediately taken to some distant part of the farm and spread thinly on the soil. Piles of poultry manure about the place provide an excellent means for insects to obtain tapeworm eggs. When the houses are cleaned, the litter should be disposed of immediately and should not be allowed to accumulate. If it is not possible to dispose of the droppings daily, they should be stored in a fly-proof manure pit.
4. Destroy all breeding places for flies. Flies breed in manure piles, rubbish heaps, old straw piles, etc.
5. Prevent flies from breeding in and around poultry houses, and from coming in contact with droppings. It may be advisable to screen the houses against flies.
6. Prevent the chicks from eating house flies by eliminating all materials which will attract the flies. Buttermilk barrels and other containers are often responsible for attracting them. In some cases, it may be advisable to raise the chicks entirely under fly screens. However, this step is not usually necessary under ordinary farm conditions.
7. Insects and earthworms should not be fed to chicks, as they may be carriers of worm eggs or larvae.
8. If the mature flock is infested they should be treated with a reliable vermicide in spring before they are allowed outdoors. Treatment should be accompanied with a general cleaning and disinfecting as described below.

In other words, a program of strict sanitation about the poultry plant is the best known remedy for the prevention of outbreaks of intestinal parasites. Carelessness and filth are causes of trouble.

Cleaning and Disinfecting

Brooder houses and permanent laying quarters should be thoroughly cleaned before putting in chicks or pullets. All litter and droppings should be removed; the floors, dropping boards, feed hoppers, and nests thoroughly scrubbed and mechanically cleaned. Do not rely on disinfectants to do a job which water and scrub brushes were intended to accomplish. Ordinary disinfectants are practically useless in killing worm eggs and larvae.

Lye is an excellent cleaning medium and is to be recommended for scrubbing. However, if iodine suspensoid is to be used following the cleaning, lye should not be used as it tends to destroy the iodine. The use of iodine suspensoid is recommended as a disinfectant against worm eggs and coccidiosis. In using this disinfectant, directions should be explicitly followed, particularly in relation to thorough cleaning before disinfection. It is absolutely useless to apply a disinfectant to a dirty surface.

Treatment for Worm Infestation

When everything else fails, treatment will have to be resorted to. There is nothing known which is satisfactory as a general flock treatment. In order

to secure results which are at all satisfactory, it is necessary that each bird be individually treated.

In the treatment of birds for roundworms, nicotine sulfate capsules and iodine vermicide have been found to give excellent results. Dr. Rietz found that carbon tetrachloride given in capsules containing 1 cc. and repeated about the seventh day gave fairly good results in treating the capillaria. Carbon tetrachloride or tetrachlorethylene in 1 cc. doses has also been recommended for treatment of roundworms.

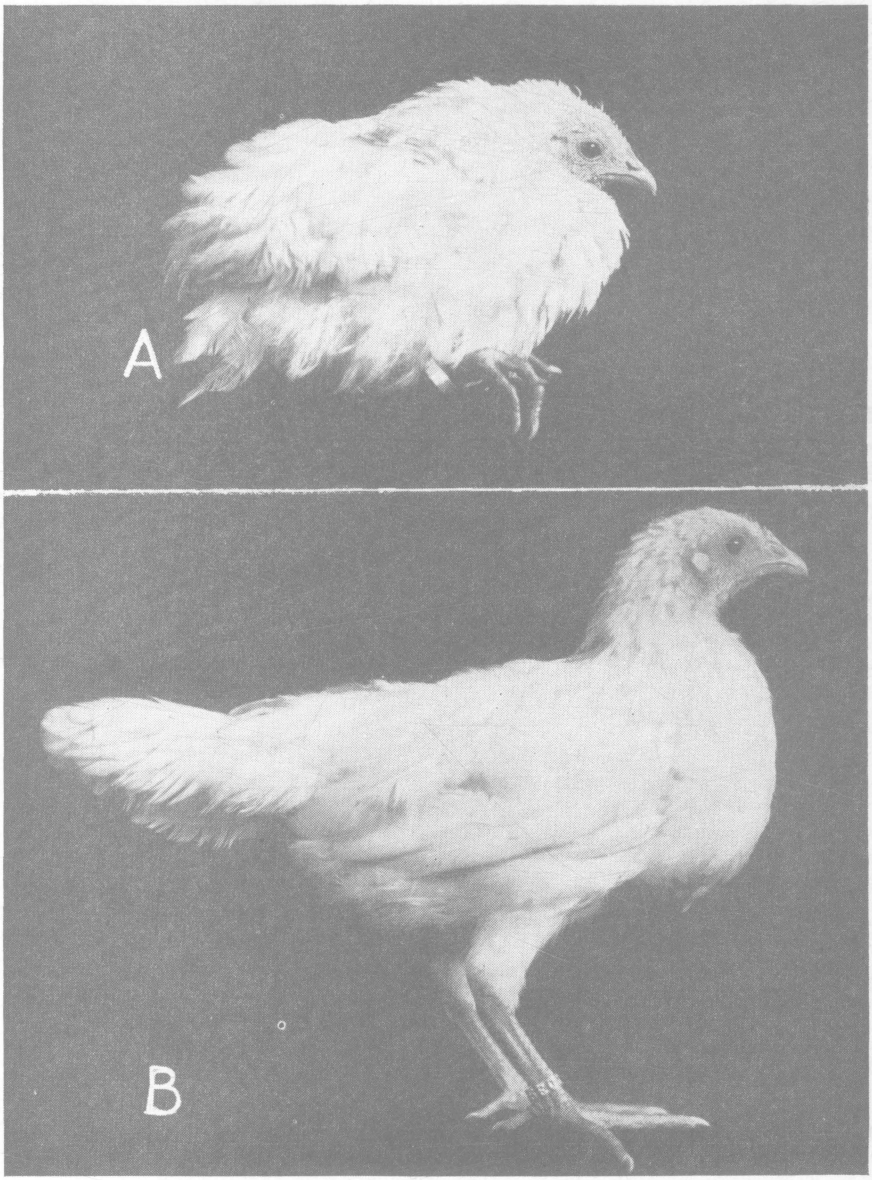

Fig. 4.—Graphic result of experiment made to show the effect of parasites on chick development. Birds are both 4 months old. *A*, chick heavily infested with worms; *B*, healthy bird, normal development. (Kansas Agl. College).

Chandler reports 100 per cent elimination of roundworms and tapeworms with iodine vermicide, and further states that iodine suspensoid is the only known satisfactory disinfectant for killing roundworm eggs and larvae.

The cecum worm does not respond readily to treatment except in cases where it is possible to get the vermicide into the ceca. It has been found that when the ceca was open, permitting the vermicide to enter, excellent results were obtained. However, if the opening of the ceca is closed at the time the birds are dosed, the treatment naturally is not effective.

Tapeworms require a treatment other than nicotine. Kamala, in 1-gram doses for chickens, and in 2-gram doses for turkeys, has been found to be very effective; although according to Dr. Cram, the kamala treatment may give bad results when certain other diseases are present. Use kamala only after feeding. Do not use this drug when digestive system is empty. Cram recommends that before attempting to treat the entire flock a few birds be treated in order to determine if there might be any serious results. It has been reported that the kamala treatment may in some cases throw the birds out of production after treatment. It is advisable that in treating with kamala, the use of potassium permanganate in the drinking water be discontinued, as a combination of the two may result in serious consequences.

Iodine vermicide is recommended for the treatment of tapeworms. While the method of dosing with iodine vermicide may appear to be difficult, the technique is not hard to master. It has the advantage of not causing any bad effects and does not throw the birds out of production. The one dose serves to eliminate both tapeworms and roundworms.

After a flock has been treated, the houses should be thoroughly cleaned and disinfected in order to destroy any eggs and larvae which might be in the pens and which would later be picked up by the birds and cause a re-infestation.

Diagnosis

Where worm infestation is suspected by any of the symptoms described on page 2, it is advisable to make sure before giving any treatment. Kill one of the affected birds, and remove the intestinal tract. The intestines should then be opened and a careful examination made for parasites. The large roundworms and tapeworms will be easily identified. The smaller tapeworms, however, may be more difficult to discover. A very satisfactory method is to open the intestine, wash out the intestinal contents and suspend the intestines in a bottle of clear water (see Fig. 2). If tapeworms are present they will be quite readily distinguished by this method. It is true, however, that the very small tapes may be difficult to distinguish. If these are suspected, it is advisable to have an examination made in the laboratory by someone who has the proper equipment for making an examination of this type.

If desired, the specimen may be submitted to a competent parasitologist and the species determined. The value in doing this would be to determine the intermediate host and to proceed to control that particular host. The following list gives the names of the most common tapes and their hosts in so far as they have been reported by investigators to date:

Tapeworms	Intermediate hosts
Choanotaenia infundibuliformis	House fly
Raillietina cesticillus	House fly, ground beetle, dung beetle
Raillietina tetragona	House fly, small snail
Hymenolepis carioca	Stable fly, dung beetle
Raillietina echinobothrida	Unknown
Davainea proglottina	Slug
Ameobotaenia sphenoides	Earthworm